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Abstract: BACKGROUND In 2018, Switzerland introduced a nationwide case-based prospective remuneration system (TARPSY), with decreasing daily rates for reimbursement of inpatient care in mental health facilities. Initially, there were concerns that declining daily rates could result in early discharges and increased readmission rates. METHODS We compared length of stay (LOS) and readmission rates for patients in adult and geriatric psychiatry treatment at four psychiatric hospitals between 2017 (the last year with the traditional remuneration system) and 2018 (the first year with TARPSY). RESULTS A total of 26,324 treatment episodes of 15,464 patients were analysed. The reduction of average LOS was not statistically significant in the first year after the implementation of TARPSY, neither in adult (mean -0.6 days, 95% confidence interval [CI] -1.6 to 0.4; $p = 0.226$) nor in geriatric psychiatry (mean -1.6 days, 95% CI -3.8 to 0.7; $p = 0.178$). When compared with the traditional remuneration system with fixed daily rates, the readmission risk was statistically significantly reduced by -9.1% (95% CI -4.9 to -13.1%; $p < 0.001$) in adult psychiatry but not in geriatric psychiatry (-6.8%, 95% CI -19.2 to 7.4%; $p = 0.329$). CONCLUSIONS If being evident at all, the effects of the new remuneration system TARPSY on LOS and readmission rates seem to be small. Concerns that declining daily rates in TARPSY would result in early discharges and increased readmission rates did not prove true in adult and geriatric psychiatry.

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The new remuneration system TARPSY in Swiss psychiatric hospitals: effects on length of stay and readmissions?

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Summary

BACKGROUND: In 2018, Switzerland introduced a nationwide case-based prospective remuneration system (TARPSY), with decreasing daily rates for reimbursement of inpatient care in mental health facilities. Initially, there were concerns that declining daily rates could result in early discharges and increased readmission rates.

METHODS: We compared length of stay (LOS) and readmission rates for patients in adult and geriatric psychiatry treatment at four psychiatric hospitals between 2017 (the last year with the traditional remuneration system) and 2018 (the first year with TARPSY).

RESULTS: A total of 26,324 treatment episodes of 15,464 patients were analysed. The reduction of average LOS was not statistically significant in the first year after the implementation of TARPSY, neither in adult (mean –0.6 days, 95% confidence interval [CI] –1.6 to 0.4; $p = 0.226$) nor in geriatric psychiatry (mean –1.6 days, 95% CI –3.8 to 0.7; $p = 0.178$). When compared with the traditional remuneration system with fixed daily rates, the readmission risk was statistically significantly reduced by –9.1% (95% CI –4.9 to –13.1%; $p < 0.001$) in adult psychiatry but not in geriatric psychiatry (–6.8%, 95% CI –19.2 to 7.4%; $p = 0.329$).

CONCLUSIONS: If being evident at all, the effects of the new remuneration system TARPSY on LOS and readmission rates seem to be small. Concerns that declining daily rates in TARPSY would result in early discharges and increased readmission rates did not prove true in adult and geriatric psychiatry.

Introduction

Switzerland is ranked second to the United States in health expenditures [1]. Approximately 12% of the Swiss gross domestic product (GDP) is spent on health care [1]. Com-

pared to other countries in the Organisation for Economic Co-operation and Development (OECD), the number of psychiatric beds per capita [2] and the average length of stay (LOS) [3] in Swiss psychiatric hospitals are still relatively high. The costs for inpatient mental health care amount to nearly 2 billion Swiss francs per year and account for approximately 12% of the total health expenditures for hospitals in Switzerland [4].

New reimbursement systems to better control for increasing costs in health care systems were discussed and implemented in many Western countries during the last decades [5–10]. Prospective payment systems aim at increasing cost-efficiency by setting the price for diagnostic procedures, treatment, and nursing prospectively. Prospective remuneration systems for mental health care have been developed and implemented in various countries such as Germany [11], Austria [12], and the US [13–15]. The US Medicare Program “Inpatient Psychiatric Facilities Prospective Payment System” (IPF PPS), for example, uses an average federal per diem base rate for payment of all eligible psychiatric providers, which is then adjusted by patient characteristics (e.g., age or diagnosis), provider characteristics (e.g., rurality of the location or local wage rates) and LOS [16].

In Switzerland, a case-based prospective remuneration system using diagnosis related groups (DRGs) has been implemented in acute (somatic) hospitals since 2012. At the beginning of 2018, Switzerland also introduced a new remuneration system for reimbursement of inpatient care in mental health hospitals [17, 18]. One of the main problems in using DRGs in mental health care is their lack of predictive value for LOS and actual costs due to resource consumption in psychiatric hospitals [7, 9, 19]. The Swiss TARPSY system, therefore, deploys elements of both case-based and per diem remuneration systems. Every patient is assigned to one of 23 financially homogeneous psychiatric cost groups (PCGs) using a hierarchical procedure. First, patients are grouped into 11 categories (so-called ba-

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sic PCGs) based on their primary diagnosis according to the ICD-10 [20]. Second, patients are then assigned to one of the 23 PCGs based on age, secondary diagnoses, and scores on the Health of the Nation Outcome Scales (HoNOS) at admission [21]. The reimbursement rates per hospital day within these PCGs are set up to adequately compensate for the actual treatment effort (resource use) per inpatient day. Daily reimbursement rates therefore vary between PCGs, and they usually follow a degressive time trend—that is, in most PCGs, daily rates are decreasing with increasing LOS as the amount of care is usually higher in earlier treatment phases than in later stages of inpatient care [17]. If patients are readmitted to the same hospital within 18 days of discharge, TARPSY prescribes administrative merging of original treatment episodes into an overarching treatment case. This rule is meant to prevent psychiatric hospitals from premature discharges of patients with a high risk of rapid readmissions. As daily rates typically decrease with increasing LOS in the TARPSY system, the reimbursement rates per treatment day are usually lower for merged cases (when compared to the separate accounting for the shorter original treatment episodes). Unlike the TARPSY system, the traditional Swiss remuneration system for inpatient mental health care used a fixed daily rate which was independent of patient characteristics and of the LOS of the patient (at least up to treatment day 60). This traditional remuneration was replaced by TARPSY on January 1, 2018.

Case-related prospective payment systems were sometimes found to decrease LOS in U.S. psychiatric hospitals [22–25] but to accelerate early discharges and rapid readmission [26]. However, such a “revolving-door” phenomenon could not be confirmed in more recent European studies on prospective remuneration systems [12, 27]. Given these mixed results, in this study, we examined whether the implementation of the TARPSY system resulted in reduced LOS on psychiatric hospital wards, and whether readmission rates had changed after TARPSY had become effective.

Methods

We used data of the four largest psychiatric hospitals in the canton of Zurich, which has approximately 1.5 million inhabitants. The Psychiatrische Universitätsklinik Zürich, the Integrierte Psychiatrie Winterthur – Zürcher Unterland, the Clenia Schlössli und the Sanatorium Kilchberg together provide approximately 90% of the psychiatric inpatient treatments in the canton of Zurich [28]. We analysed all inpatient treatment episodes (cases) in the departments of adult psychiatry and geriatric psychiatry that had been completed in the years 2017 (the last year with the traditional remuneration system) and 2018 (the first year with TARPSY). (For child and adolescent psychiatry, TARPSY was not implemented until 2019.)

All psychiatric hospitals are obligated to annually provide statistical data on their treatment cases to the Department of Health of the canton of Zurich [29]. If a patient was readmitted to the same hospital within 7 or 15 days (2017) or within 18 days (2018), the hospitals provided only one merged (overarching) treatment case to the Department of Health. When using this aggregated dataset of the Department of Health to compare the LOS and readmission

rates between the two remuneration systems, we therefore first had to reconstruct the primary (original) treatment episodes. The LOS was then calculated using the formula:

$$\text{LOS} = \text{date of admission} - \text{date of discharge} + 1 \text{ day}$$

The merging of treatment episodes with rapid readmission into one overarching treatment case by the hospitals resulted in loss of socio-demographic and clinical information. For instance, the primary diagnosis of the overarching case represented the disorder which required the greatest therapeutic effort across all merged primary treatment episodes [30, 31]. It was no longer possible to reconstruct the factual primary diagnosis for each specific primary case.

The local ethics committee of the canton of Zurich declared non-responsibility for this study. The Swiss Federal Act on Research Involving Human Beings does not apply to our study because we made further use of anonymised health-related personal data only.

Data analysis

All analyses were performed separately for adult psychiatry (usually 18 to 64 years) and for geriatric psychiatry (usually >65 years). Within these age groups, analyses were stratified for the most frequent primary diagnoses according to ICD-10 (F0, F1, F2 etc.) [32].

Some of the patients had multiple inpatient treatment episodes during the 24-month study period, sometimes even in different psychiatric hospitals. We used multilevel (mixed-effects) linear regression models with random intercepts to account for a hierarchical data structure where treatments were nested within patients and patients were nested within hospitals. In order to examine the effects of the remuneration systems on mean LOS, the remuneration system was modelled as fixed effect and patients and hospitals were included as random effects. We used Huber's sandwich method [33] to estimate robust standard errors in order to account for typically right-skewed LOS data in hospitals and for possible heteroscedasticity of variances.

Survival analyses were used to compare survival times until readmissions between the two remuneration systems. Some patients had more than one readmission per year. We therefore used the model of Prentice, Williams and Peterson [34] to estimate confidence intervals that take into account possible within-patient dependencies between recurrent events (readmissions).

Analyses were performed using STATA (version 15), SPSS (version 24), and R (packages “lme4”, “robust-lmm”, “survival” and “survminer”).

Results

Adult psychiatry

In total, 22,298 inpatient treatment episodes (of 12,453 patients) had been completed in the adult psychiatry departments of the four psychiatric hospitals during the last year prior to the implementation of the TARPSY system (2017) and the first year thereafter (2018), respectively. Sixty-six (0.3%) records (episodes) had been excluded from these numbers due to inconsistent information. At admission, the patients' mean age was 40.8 years (standard deviation [SD] 14.1) and 46.4% were female. Patients had between 1 and 47 completed treatment episodes during the 24-month

study period (mean 1.8, SD 1.8). Variance decomposition in a linear null model suggested that approximately 1% of the variance in LOS can be explained by differences between hospitals (intra-class correlation coefficient [ICC] 0.009) and another 24% of the variance by differences between patients (ICC 0.240). The remaining 75% of the variance in LOS relied on differences between treatment episodes. (Note that crossed effects between patients and hospitals could not be calculated in this model due to lack of sufficient computational power; those 12.5% of the patients who had been treated in multiple hospitals during the study period were analysed separately for each hospital.)

Length of stay

Table 1 and figure 1a show the mean and median LOS before and after the implementation of TARPSY. Overall, the estimated mean LOS was not statistically significantly reduced with TARPSY when compared to the preceding year with the traditional remuneration system (mean -0.6 days, 95% confidence interval [CI] -1.6 to 0.4; $p = 0.226$). However, a statistically significant reduction of LOS was evident in patients with substance use disorders (ICD-10 F1: mean -1.1 days, 95% CI -1.7 to -0.5; $p = 0.001$) and in patients with neurotic, stress-related and somatoform disorders (F4: mean -1.9 days, 95% CI -3.0 to -0.7; $p = 0.001$).

Readmissions

The patients in adult psychiatry had between 1 and 24 inpatient treatment episodes (mean 1.5, SD 1.2) in the last year prior to the implementation of TARPSY, and between 1 and 28 inpatient treatment episodes (mean 1.5, SD 1.3) in the first year thereafter. Survival analyses to compare times to readmission between the two remuneration systems were restricted to the first five inpatient episodes (i.e.,

to the first four readmissions) per patient in order to get more reliable model parameter estimates [34]. Truncation of later readmissions resulted in exclusion of 1.7% (2017) and 1.6% (2018) of the treatment cases.

Figure 2a shows the survival rates until readmission in both remuneration systems. Overall, the relative risk of readmission was 9.1% lower after TARPSY had become effective (hazard ratio [HR] 0.909, 95% CI 0.869 to 0.951; $p < 0.001$). Sensitivity analyses using the full dataset (i.e., without truncation after the fifth inpatient episode) provided very similar results (HR 0.914, 95% CI 0.875 to 0.954; $p < 0.001$).

Survival analyses within the most prevalent diagnostic subgroups were restricted to the first two readmissions per patient for above mentioned reasons (reliable parameter estimates). Table 2 shows the HRs for readmissions in the new vs. the traditional remuneration system. After TARPSY had become effective, readmission risk was significantly reduced by 13.0% (95% CI 0.793 to 0.956; $p = 0.004$) in patients with schizophrenia (F2) and by 16.4% (95% CI 0.763 to 0.915; $p < 0.001$) in patients with primary affective disorders (F3).

Geriatric psychiatry

In the geriatric psychiatry departments of the four psychiatric hospitals a total of 4026 inpatient treatment episodes (of 3011 patients) had been completed in the last year prior to the introduction of the TARPSY system (2017) and in the first year thereafter (2018). At admission, the patients' mean age was 74.4 years (SD 11.3) and 58.8% were female. Patients had between 1 and 12 completed treatment cases on hospital wards during the 24-month study period (mean 1.3, SD 0.8). Variance decomposition in a linear

Table 1: Length of stay in adult psychiatry before (2017) and after (2018) the implementation of TARPSY, overall and in most prevalent diagnostic groups according to ICD-10 (22,298 completed treatment episodes of 12,453 patients).

Primary diagnosis (ICD-10)	Traditional remuneration system (2017)					TARPSY (2018)					b	Robust SE	95% CI lower	95% CI upper	p-value
	n	M	SD	Md	IQR	n	M	SD	Md	IQR					
F1	2243	21.5	19.5	16	23	2442	19.8	17.7	15	21	-1.108	0.326	-1.747	-0.469	0.001
F2	2316	25.7	26.8	16	28	2371	25.5	33.5	15	26	0.045	1.129	-2.167	2.258	0.968
F3	3561	29.8	24.2	25	36	3497	29.7	24.2	25	36	-0.190	0.599	-1.364	0.985	0.751
F4	1683	20.0	24.0	9	22	1541	18.6	21.4	8	22	-1.873	0.576	-3.002	-0.744	0.001
F6	952	25.6	26.6	15	33	953	24.7	39.3	13	30	-1.224	1.311	-3.795	1.346	0.351
Other or missing	379	23.3	26.4	13	26	360	22.9	28.1	13	23	-0.358	1.604	-3.502	2.785	0.823
All	11,134	25.2	24.4	17	31	11,164	24.5	27.0	17	16	-0.621	0.513	-1.626	0.384	0.226

CI = confidence interval; M = mean; Md = Median; IQR = interquartile range; SE = standard error F1 = Mental and behavioural disorders due to psychoactive substance use; F2 = Schizophrenia, schizotypal and delusional disorders; F3 = Mood (affective) disorders; F4 = Neurotic, stress-related and somatoform disorders; F6 = Disorders of adult personality and behaviour

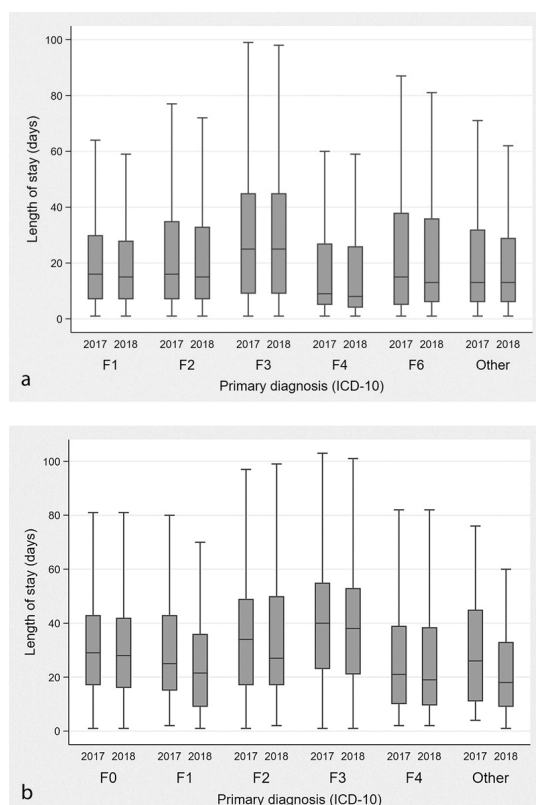
Table 2: Hazard ratios of the readmission risks in the TARPSY system versus the traditional remuneration system for the most prevalent diagnostic groups (ICD-10) in adult psychiatry (12,453 patients).

Primary diagnosis (ICD-10)	n	Hazard ratio	Robust SE	95% CI lower	95% CI upper	p-value
F1	4214	0.925	0.045	0.840	1.018	0.111
F2	4086	0.870	0.042	0.793	0.956	0.004
F3	6786	0.836	0.039	0.763	0.915	<0.001
F4	3074	0.971	0.073	0.837	1.126	0.696
F6	1514	1.013	0.077	0.872	1.177	0.869
Other or missing	648	1.031	0.135	0.798	1.334	0.814
All	21,531	0.909	0.021	0.869	0.951	<0.001

CI = confidence interval; SE = standard error F1 = Mental and behavioural disorders due to psychoactive substance use; F2 = Schizophrenia, schizotypal and delusional disorders; F3 = Mood (affective) disorders; F4 = Neurotic, stress-related and somatoform disorders; F6 = Disorders of adult personality and behaviour Analyses within diagnostics subgroups were restricted to the first 3 inpatient episodes per patient; analyses over all diagnoses were restricted to the first 5 inpatient episodes per patient.

null model suggested that approximately 3% of the variance in LOS can be explained by differences between hospitals (ICC 0.033) and another 23% of the variance by differences between patients (ICC 0.227). (Note that crossed effects between patients and hospitals could not be calculated in this model due to lack of sufficient computational power; those 4.1% of the patients who had been treated in multiple hospitals during the study period were analysed separately for each hospital.)

Figure 1: Boxplots of the length of stay in the four psychiatric hospitals before (2017) and after (2018) the implementation of TARPSY, overall and in most prevalent diagnostic groups according to ICD-10: (a) adult psychiatry (22,298 completed treatment episodes of 12,453 patients); (b) geriatric psychiatry (4026 completed treatment episodes of 3011 patients). F0 = Organic, including symptomatic, mental disorders; F1 = Mental and behavioural disorders due to psychoactive substance use; F2 = Schizophrenia, schizotypal and delusional disorders; F3 = Mood (affective) disorders; F4 = Neurotic, stress-related and somatoform disorders; F6 = Disorders of adult personality and behaviour.



Length of stay

The estimated mean LOS was not statistically significantly reduced after TARPSY became effective, neither for overall diagnoses (mean -1.6 days, 95% CI -3.8 to 0.7 ; $p = 0.178$) nor within any of the most prevalent diagnostic subgroups (table 3 and fig. 1b).

Readmissions

The patients used between one and six inpatient treatment episodes (mean 1.2, SD 0.6) in the last year prior to the implementation of TARPSY, and between one and seven inpatient treatment episodes (mean 1.2, SD 0.6) in the first year thereafter. Survival analyses to compare times to readmission between remuneration systems were restricted to the first readmission of each patient in order to get stable

Figure 2: Kaplan-Meier curves: Survival rates until readmission after discharge from (a) adult psychiatry or (b) geriatric psychiatry in the two remuneration systems.

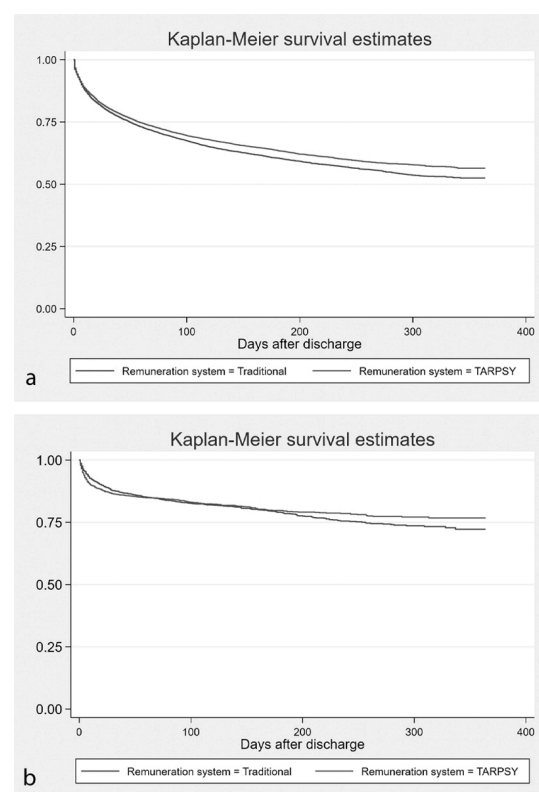


Table 3: Length of stay in geriatric psychiatry before (2017) and after (2018) the implementation of TARPSY, overall and in most prevalent diagnostic groups according to ICD-10 (4026 completed treatment episodes of 3011 patients).

Primary diagnosis (ICD-10)	Traditional remuneration system (2017)					TARPSY (2018)					b	Robust SE	95% CI lower	95% CI lower	p-value
	n	M	SD	Md	IQR	n	M	SD	Md	IQR					
F0	796	32.2	20.7	29	26	833	31.0	20.3	28	26	-0.966	1.730	-4.357	2.424	0.576
F1	157	29.2	19.6	25	28	156	24.8	18.7	21.5	27	-4.791	2.587	-9.861	0.278	0.064
F2	300	37.9	28.0	34	32	230	34.6	28.3	27	33	-3.177	2.939	-8.937	2.583	0.280
F3	628	40.8	24.2	40	32	598	40.0	27.2	38	32	-0.613	0.617	-1.823	0.597	0.321
F4	113	26.0	19.2	21	29	120	26.6	23.0	19	29	0.252	2.821	-5.276	5.781	0.929
Other or missing	32	30.8	21.1	26	34	63	29.1	41.6	18	24	1.676	3.405	-4.999	8.350	0.623
All	2026	35.1	23.3	32	31	2000	33.3	24.9	29	30	-1.567	1.163	-3.846	0.712	0.178

CI = confidence interval; M = mean; Md = Median; IQR = interquartile range; SE = standard error F1 = Mental and behavioural disorders due to psychoactive substance use; F2 = Schizophrenia, schizotypal and delusional disorders; F3 = Mood (affective) disorders; F4 = Neurotic, stress-related and somatoform disorders; F6 = Disorders of adult personality and behaviour

model parameter estimates [34]. Truncation of later readmissions resulted in exclusion of 4.7% (2017) and 4.2% (2018) of the treatment cases, respectively. The relative risk of readmission did not differ significantly between the remuneration systems, neither over all diagnoses (HR 0.932, 95% CI = 0.808 to 1.074; $p = 0.329$; [fig. 2b](#)) nor within the most prevalent diagnostic subgroups ([table 4](#)). Sensitivity analyses for all diagnoses using the full dataset (no truncation of later readmissions) provided very similar results (HR 0.941, 95% CI 0.820 to 1.079; $p = 0.380$).

Discussion

Overall, the average LOS were not significantly reduced in the first year after the implementation of the TARPSY system in the four psychiatric hospitals examined here, neither in adult psychiatry departments (mean -0.6 days; $p = 0.226$) nor in geriatric psychiatry departments (mean -1.6 days; $p = 0.178$). However, when compared to the traditional remuneration system, the readmission risk was statistically significantly reduced by -9.1% ($p < 0.001$) in adult psychiatry. For geriatric psychiatry no such effect on readmission risk was evident (-6.8% ; $p = 0.329$). Initial concerns that declining cost weights in TARPSY could result in early discharges and higher readmission rates [35], therefore, did not prove true. This is in contrast to some previous findings from the United States [23–26], but has already been suggested in an earlier pilot attempt in one of the four psychiatric hospitals, where the introduction of a remuneration system with decreasing daily rates was not related to early discharges and rapid readmissions [27]. In this context, it is important to note that the TARPSY system was not introduced with the intention to encourage hospitals to reduce the LOS, the relatively flat degression of the cost weights simply reflected the observed patterns of decreasing average daily costs [18].

The TARPSY system prescribes allocation of patients to basic PCGs according to their primary ICD-10 diagnosis [17]. In adult psychiatry, treatments of inpatients with primary substance use disorders (ICD-10 F1) became significantly shorter (mean -1.1 days) after the implementation of TARPSY ($p < 0.001$). The relatively low daily rates for longer treatments in some of the PCGs related to substance use disorders [17] might have operated as incentive to reduce the LOS in these patient groups. Interestingly, the reduction of the LOS in patients with substance use disorders turned out to be sustainable – readmission rates were not increased by TARPSY, despite shorter inpatient treatments.

Furthermore, some potential for shortening inpatient treatments might have existed in patients with anxiety and stress-related disorders (F4). The average LOS was reduced by $M = -1.9$ days in this patient group ($p < 0.001$) following the implementation of TARPSY, again without causing increased readmission rates.

In the remaining groups of primary diagnoses (i.e., in the remaining basic PCGs) the average LOS was not statistically significantly changed following the implementation of TARPSY in adult psychiatry. However, readmission risks were significantly reduced by -13.0% in patients with schizophrenia, schizotypal and delusional disorders (F2; $p = 0.004$) and by -16.4% in patients with mood (affective) disorders (F3; $p < 0.001$). This finding is difficult to interpret, and for the moment, we lack any convincing explanation.

In geriatric psychiatry, the implementation of TARPSY did not have a statistically significant effect on the LOS or readmission rates, neither over all cases (primary diagnoses) nor in any of the diagnostic subgroups. However, the effect sizes of the changes in geriatric psychiatry were sometimes very similar or even more pronounced than in adult psychiatry. For example, the reduction of the LOS in patients with substance use disorders averaged -1.1 days in adult psychiatry ($p < 0.001$) and -4.8 days in geriatric psychiatry ($p = 0.064$). The lack of statistically significant effects in geriatric psychiatry may, therefore, at least partly be explained by the much lower-case numbers resulting in less statistical power.

Some further limitations warrant attention. Most importantly, studies with historical controls preclude any conclusions about causalities. We cannot exclude that factors other than the remuneration systems affected comparisons of the LOS and readmission rates between the years before and after the implementation of TARPSY. For instance, we did not know whether the number of involuntary referrals to hospitals had changed between 2017 and 2018. Due to Swiss data protection laws and agreements with the four participating psychiatric hospitals, socio-demographic and clinical information could not be reconstructed for original treatment episodes in the database of the Department of Health of the canton of Zurich if treatment cases had been administratively merged due to rapid readmissions. However, the four hospitals examined here are legally bound to provide primary mental health care and they cover the vast majority of inpatient treatments ($\sim 90\%$) in the canton of Zurich. In consequence, there is little reason to suppose that the case mix of the patients had significantly changed between 2017 and 2018. For instance, at least among the

Table 4: Hazard Ratios of the readmission risks in the TARPSY system versus the traditional remuneration system for the most prevalent diagnostic groups (ICD-10) in geriatric psychiatry (3011 patients).

Primary diagnosis (ICD-10)	n	Hazard ratio	Robust SE	95% CI lower	95% CI upper	p-value
F0	1579	1.090	0.131	0.862	1.379	0.473
F1	290	0.781	0.187	0.488	1.250	0.303
F2	480	0.865	0.151	0.614	1.218	0.405
F3	1176	0.808	0.112	0.616	1.061	0.125
F4	226	1.299	0.420	0.689	2.447	0.419
Other or missing	80	1.186	0.544	0.483	2.914	0.710
All	3831	0.932	0.068	0.808	1.074	0.329

CI = confidence interval; SE = standard error F1 = Mental and behavioural disorders due to psychoactive substance use; F2 = Schizophrenia, schizotypal and delusional disorders; F3 = Mood (affective) disorders; F4 = Neurotic, stress-related and somatoform disorders; F6 = Disorders of adult personality and behaviour Analyses were restricted to the first 2 inpatient episodes per patient.

non-merged initial inpatient episodes, the proportion of involuntary admissions did not significantly differ between the two years, neither in adult (22.6 vs 22.7%; $p = 0.861$) nor in geriatric psychiatry (46.0 vs 44.9%; $p = 0.477$).

In addition, the assignment of treatment cases (episodes) to remuneration systems happened according to the date of discharge (and not on the date of admission). The aggregated dataset of the Department of Health of the canton of Zurich included all treatment episodes that had been completed in the years 2017 and 2018. In consequence, we had no information on treatment cases which had been admitted in 2018 (or earlier) but had been discharged after 31 December 2018. However, the number of discharged cases can be used as a very close proxy for the number of admitted cases per year.

Furthermore, our findings were restricted to the first year after the implementation of TARPSY. This observation period might have been too short to fully detect all consequences of the new remuneration system; i.e., some effects might become evident only with larger temporal delay. Unfortunately, data for the years prior to 2017 could not be used to control for a potential confounding of our results by a general underlying trend of decreasing LOS or readmission rates in psychiatric hospitals [31]. Discharge and readmission dates of administratively merged treatment episodes were not documented in the database of the Department of Health of the canton of Zurich for the years prior to 2017. It was therefore not possible to reconstruct the LOS of the primary treatment episodes and time to readmission in administratively merged cases for earlier years. Inpatient treatments of the Zurich population in psychiatric hospitals in other cantons may be another source of bias. However, the proportion of inhabitants of the canton of Zurich who used psychiatric hospitals within the canton was rather high and remained stable between 2017 (87%) and 2018 (87%) [28, 36]. In the year before the implementation of TARPSY, clinical diagnoses had no financial impact. This might raise concerns regarding their validity. However, commonly used clinical examination techniques were shown to render valid primary diagnoses under routine conditions, at least at the level of ICD-10 main categories (F0, F1, F2, etc.) [37]. Finally, our findings are based on data of the four largest psychiatric hospitals for general adult and geriatric psychiatry in the canton of Zurich. Whether our findings can be generalised to other cantons, age and patient groups, and to highly specialised mental health facilities with a very narrow treatment focus (e.g., eating disorders only) remains unanswered.

In summary, except for substance use disorders (F1) and anxiety and stress-related disorders (F4) in adult psychiatry, the potential to reduce the LOS in psychiatric hospitals with a remuneration system that sets incentives for shorter hospital stays seems to be limited. However, readmission rates were reduced after the implementation of TARPSY, at least in adult psychiatry. At first glance, one could suppose that the lower daily rates resulting from the merging of treatment episodes in the case of rapid readmissions motivated psychiatric hospitals to be more cautious when admitting patients. However, readmission rates were generally reduced and not only within the first 18 days after the discharge of patients (i.e., when readmissions resulted in a merging of treatment episodes). It therefore remains un-

clear whether the lower readmission rates were an actual consequence of the new remuneration system, an indication of a generally decreasing trend in readmissions over time, or whether they came about for some other reasons.

If being evident at all, the effects of the new remuneration system TARPSY on LOS and on readmission rates were generally small. This is in line with previous findings from a pilot attempt to introduce a case-based remuneration system with incentives to shorten the LOS and prevent early readmissions in one of the four psychiatric hospitals examined here [27].

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